CUTEC NEWS

Chemistry meets energy

FACTS · INFORMATION · ANALYSES

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Rooms available!

Signs indicating “Rooms available” are a common sight in hotel and guesthouse windows. We might well also put up such a sign at our premises in the Leibnizstrasse – though what we have to offer is of interest not to tourists but to engineering and science graduates looking for attractive career opportunities. In actual fact of course, candidates looking for posts are highly unlikely to drive round reading vacancies signs in office windows. Instead of that, we have produced a recruitment brochure setting out all the career opportunities open to candidates who apply for jobs with CUTEC. The brochure includes reports from current members of the workforce and former employees who have since moved on to other posts in industry or higher education, describing their experiences of working for CUTEC. The brochure will not only be available in printed form but also online, downloadable from our website. Our aim is that the brochure should serve as a recruitment marketing tool, supplementing our advertising on various Internet job exchanges and in print media by highlighting CUTEC’s attributes as an employer. And talking of highlights: the article by Dr.-Ing. Lindermeir in this issue is something you really should not miss, as he recounts the story of his first year heading the Department of Chemical Processes and sets out the strategy his Department will be pursuing in the years ahead. Less strategy-related, but no less interesting, is the article by Dr.-Ing. Vodegel about his new project in the field of biomass conversion: OptiBtLGas – Designer fuel from green gas. Another fascinating insight is provided by Dr.-Ing. Schröder, a former CUTEC employee who reports on the first company to be established originating from CUTEC and on his experiences to date as managing director of that company, aquen aqua-engineering GmbH.

If you happen to be someone who might benefit from reading the brochure profiled in this issue of CUTEC News, and if you could imagine yourself “working where other people go on holiday”, then don't hesitate to get in touch with us: we’ve always got rooms available!

Best regards,

Otto Carlowitz

IN THIS ISSUE

aquen GmbH – the first company to be established originating from CUTEC

Production and sale of CUTEC developments on the global market

After over two and a half years’ preparation, the first company to be established originating from CUTEC has now launched its business operations. The new company, aquen aqua-engineering GmbH was officially founded in the town of Goslar on June 12, 2008. This new business venture demonstrates the entrepreneurial spirit of CUTEC and underlines its expertise in turning research projects into marketable products. The business of aquen GmbH is in the treatment of sludge and waste water and in energy recovery from bio-sludge. In those fields, aquen GmbH will initially be primarily producing and marketing three products and processes developed to market maturity by CUTEC. The spin-off business is headed by Dr. Christian Schröder,

The shareholders in aquen aqua- engineering GmbH. From left: Dipl.-Ing. Felix Wentz, Dr.-Ing. Christian Schröder and Prof. Dr.-Ing Otto Carlowitz.

who formerly worked for many years in CUTEC's Department of Physical and Biological Processes. Alongside Dr. Schröder is Martin Bröhl, a CUTEC-trained industrial mechanical engineer, who joined the new company with effect from July 1, 2008. This transfer of personnel ensures continuity of process and production know-how.

Providing the ideal complement to the scientific background of CUTEC, the steel projects company Stahl-Projektbau Wentz GmbH based in Langelsheim was acquired as a partner. In order fully to exploit the synergies in production, aquen GmbH has now likewise relocated to Langelsheim. Initial capital investment of

Continued on page 6

Visit by German Federal Environment Minister Sigmar Gabriel to CUTEC

On Saturday May 17, 2008, Germany's Federal Environment Minister Sigmar Gabriel paid a visit to CUTEC. At a relaxed, low-key event, Professor Carlowitz made a brief presentation about CUTEC and the strategy it is pursuing. The focus of his presentation was on the strategy in relation to biomass conversion. The subject is currently a hot political issue, and immediately aroused the interest of the Minister. In a lively discussion, Minister Gabriel outlined the global problems being encountered in connection with the recovery of biodiesel from vegetable oils. He pointed out that in Brazil, for example, marshland is being drained merely to create more space for fast-growing palm trees in order to meet rising demand. It has become clear that further addition of palm oil to the refinery process needs to be prevented in future by political action. As the Minister put it, a different approach is needed to meet the legally prescribed admixture ratio in fuel: "If you have a solution, I will provide money; if you put me off until 2020, I won't have any money either" (source: GZ, 19.05.2008) were the Environment Minister's actual words.

Discussion of potential future solutions during the tour of the CUTEC facility (from left: Sigmar Gabriel, Werner Grübmeyer, Prof. Carlowitz)

Professor Carlowitz demonstrated that CUTEC is indeed working on such a solution: "The recovery of energy and production of fuel from residual biomass – such as straw, biosolids or sewage sludge – is not contrary to the interests of nature conservation, nor to those of food production". He stated that decentralised plant design concepts are particularly interesting in the context.

On a tour of the pilot plant halls, the Environment Minister was pleasantly surprised to see that developments at CUTEC extended well beyond laboratory scale. In conclusion, Minister Gabriel gave an assurance that he would strengthen the political fight against palm oil and support the search for alternative methods. (wo)

First fuel cell Summer School held by the State of Lower Saxony

50 undergraduates and Ph.D. students from all over the state of Lower Saxony spent the first week of September not, as usual, enjoying the latter part of their Summer vacation, but instead chose to engage in some hard work: a week's Summer School hosted by fuel cell experts from around the state. Speakers included representatives from the major fuel cell companies, such as Mr. Ballhausen, Mr. Barth and Dr. Arndt from EWE; Dr. Schmitz and Dr. Unwerth from Volkswagen; Dr. Huiberts from H.C. Starck; Dr. Hoffmann from Siemens; and Mr. Zerbst from the SYCOC Corporation. Participants were provided with a first-hand insight into the problems currently being encountered in fuel cell technology and the disciplines in which graduates are sought to work in the field. The scientific principles underlying the technology were set out by local experts Prof. Borchardt, Dr. Dörrer, Prof. Turek, Prof. Kunz and Mr. Kulakarni from the Technical University of Clausthal; Prof. Seume and Prof. Caro from the Leibniz University in Hanover; and Dr. Cremers from the Fraunhofer Institute for Chemical Technology. The in part highly complex and demanding theoretical subject matter was interwoven with some practical exercises on a Heliocentris fuel cell, a computerised simulation of the internal processes, as well as study trips to the Volkswagen research facility in Isenbüttel, to the Institutes of Chemical Process Engineering and Metallurgy in Clausthal, and to CUTEC.

The event was organised by Mr. Dietrich from the Science Section of the State of Lower Saxony Fuel Cell Initiative, in conjunction with the event's host, Professor Seume, director of the Institute of Fluid Dynamics and Turbomachines at the Leibniz University in Hanover.

The participants considered the fee of just 50 € for this high-calibre programme, including accommodation at the Hotel "Schlafgut" and meals in the university dining halls, to be a real bargain. This attractive offer was made possible by financial support from the members of the State of Lower Saxony Fuel Cell Initiative. The member industrial concerns and the representatives of the Lower Saxony Ministries of the Environment, Trade and Industry and Science and Research participating in the Initiative were seeking to spread knowledge of this key new technology of the future among students, in the hope of attracting graduate recruits to work in the field and guide it through to market launch. The response from interested students was so great that the event was oversubscribed, and the 50 participants who did succeed in gaining a place were so enthused by the first Summer School that they returned to their colleges full of stories of their terrific late-Summer week in Hanover and eager to support the next event of its kind. (di)

Group photo of Summer School participants

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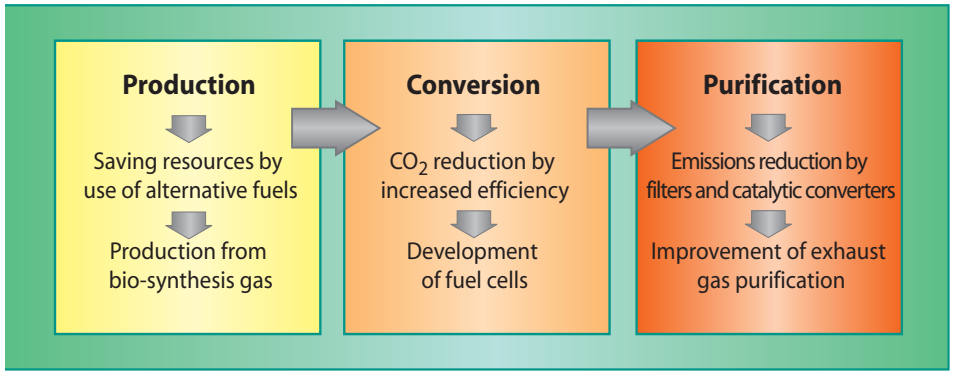
Strategy and development of the Department of Chemical Processes

Chemistry meets energy!

Chemically stored energy from fossil fuels such as coal, oil and gas plays a key role in all our everyday lives. We need gas and oil to heat our homes, and we use petrol and diesel to keep mobile. Consequently, some 95% of the mineral oil produced is used to power vehicles and for heating; only the remaining 5% is used in synthesising plastics, pharmaceuticals, and so forth. However, the availability of fossil fuels is decreasing, owing to the depletion of oil and gas reserves and our increased energy consumption. As a result, there is a greater demand than ever before for alternative, sustainable and environmentally friendly sources of energy and methods of energy conversion, in order to reduce our dependency on oil and gas and prevent CO_2 emissions. In view of those issues, CUTEC's Department of Chemical Processes has long been focussed on the process chain stretching from the fuel source, to the drive system, to the resultant emissions.
Current challenges in this are:

- the production of fuel from biogenous synthesis gas;
- the use of fuel cells to convert easy-to-store chemical energy into widely usable electrical energy in the most efficient way possible;
- testing and evaluation of catalysts under demanding operating conditions (e.g. BtL synthesis, exhaust gas purification, reforming).

In the field of fuel production from biomass, the Department is currently pursuing two approaches: firstly, the production of Fischer-Tropsch diesel and other fuels from biomass-based synthesis gas. This can be produced from materials such as straw or sewage sludge, so as to avoid competing with the needs of food production in terms of the use of valuable resources. A second aim is to provide the simplest possible channels for the synthesis of marketable basic chemicals. For example, low reaction temperatures and pressures and small numbers of by-products have a favourable effect on investment and operating costs. With regard to both approaches the principal focus is on decentralised plant installations, in order to work with locally generated biomass. The scientific work is accompanied by estimates of cost and potential so as to incorporate economic factors into planning at an early stage.

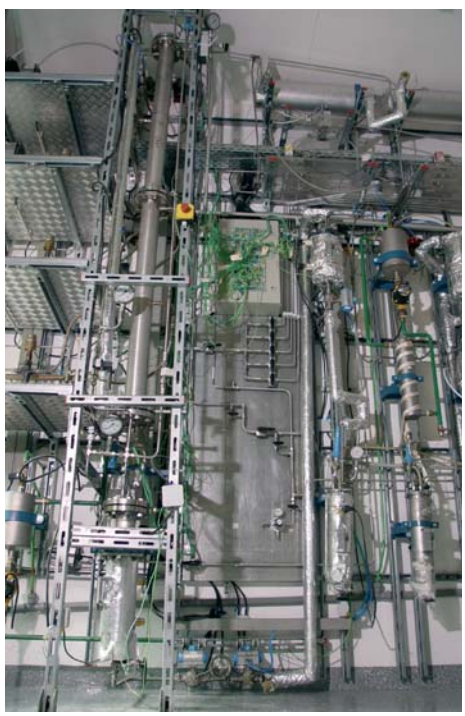


Approaches employed by the Department of Chemical Processes

Fuel cells are seen as a highly promising method of producing electrical energy in future. The way in which they function means they are able to achieve higher electrical efficiencies than the commonly used internal combustion engines. The work of the Department in this field is concerned with the high-temperature solid oxide fuel cell (SOFC), which converts fuels such as natural gas, methane or propane into electricity at 850 °C. By employing innovative system methods and developing improved components, the Department is seeking to answer the technological questions relating to this technology to enable it to be put into practical use on a large scale.

Purification of exhaust gases can help to reduce pollutant emissions. Diesel particulate filters such as are now fitted in modern-day motor vehicles as standard are tested on the Department's engine test bench in terms of their filtering efficiency and regeneration capabilities, in order to discover further potential for optimisation.

The department has the experience, expertise and the necessary infrastructure, in the form of test stands, plant and equipment, to handle all the various areas of work involved. All those resources will continue to be deployed in future in developing alternative methods for the production and supply of energy and raw materials. Because one thing is certain: stable, affordable supplies of energy and basic chemicals will be key to safeguarding future prosperity. (li)



Experimental plant for the production of Fischer-Tropsch fuels

CUTEC presentation at Renewable Energy Asia 2008

The "Renewable Energy Asia" international trade fair was held from June 4 to 7, 2008 in Bangkok, Thailand. CUTEC was represented at the fair as part of the joint "Renewable Energy from Germany" stand. The key aspects of the CUTEC presentation were its activities in the fields of Renewable Energy (Energy Park), Biomass-to-Liquid and Biogas. Visitors to the fair showed great interest in the work of the Institute. Among the many visitors to the stand were the Thai Energy Minister, Lt. Gen. Poonpirom Liptapanlop, and the German Ambassador Dr. Christoph Brümmer.

Running in parallel with the trade fair was an international congress organised by the Joint Graduate School of Energy and Environment (JGSEE). CUTEC staff member Werner Siemers is currently working on secondment to the JGSEE as part of a GTZ-CIM project. (sie)

Presenting: the Sustainability Management Cluster

From the larva to the butterfly

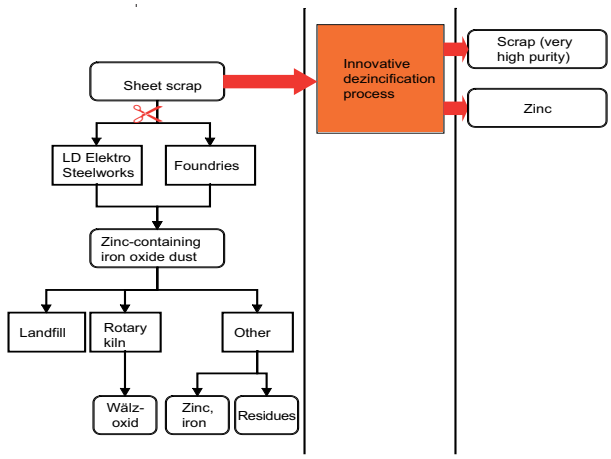
The Sustainability Management Cluster is a recently established organisational unit at CUTEC tasked to bundle interdisciplinary tasks relating to economic and ecological sustainability. The staff includes Dr.-Ing. Britta Kragert, Dipl.Kfm. A. Sauter and Dr. Torsten Zeller.

The role of the Cluster is to implement the recommendation of the Scientific Commission to establish the interlinking of technical and non-technical issues as one of the unique features of the organisation. The Cluster structure offers advantages over the conventional departmental structure in its enhanced possibilities for networking and collaboration across the broad spectrum of the Institute's disciplines and subject areas. The main activities of the Cluster are in research projects and third-party funded projects relating to sustainability of energy and raw materials. Against the current background of CO_2 certificate trading and ongoing trends in the energy market, there is increased interest from industry in the use of biomass as an energy source.

One project currently in progress in manufacturing industry, for example, is investigating the potential for substituting fossil-based input materials and fossil fuels with biomass. This project directly interlinks process engineering expertise with eco-balancing methodology and commercial analysis. The core questions with which it is dealing are appraisals of the suitability of the biomass for the specific process and its reliable availability in the region, also in terms of usage cascading and effects on the CO_2 balance. The essential analysis of the commercial viability of this potential substitution rounds off the range of topics covered by the project.

One example in the field of resource efficiency is an industrial project relating to zinc recycling. The academic partner in this subject area is Professor Gock from the Institute for Mineral Processing and Waste Disposal at the Technical University of Clausthal. The processing technique was developed by Professor Gock. The work of the Cluster covers the raw materials market, material flow management, appraisal of the commercial viability and ecological sustainability of the process, as well as project management.

The potential synergies deriving from this type of collaboration are also illustrated by the development of a project idea by the Cluster which has to date passed the first stage of a German Federal Ministry of Education and Research (BMBF) tender procedure. The project consortium includes representatives from the automotive industry, the foundry industry, raw material traders, plant manufacturers and researchers.



IInnovative cold dezincification

Research and contract work in the field of preventive and curative environmental protection are additional areas in which the Cluster operates. On key strategic projects, the Cluster handles marketing and project management tasks. A major area of focus in future will be on optimising collaboration with the process engineering disciplines. This is an area in which tensions can sometimes arise when "dry engineering" encounters (supposedly) "non-technical" expertise. We are pleased to take up that challenge – any tensions or disputes will certainly not

Dr. Wilhelm Priesmeier (MdB) visits CUTEC

Member of Federal Parliament accompanied by SPD party delegation

Member of the German Federal Parliament Dr. Wilhelm Priesmeier visited CUTEC on August 1st as part of his Summer tour of his constituency. He was accompanied by a small delegation from the German Social Democratic Party (SPD) comprising Member of the State Assembly Ms. Petra Emmerich-Kopatsch, Mr. Walter Lampe and Mr. Jürgen Burmester. Professor Carlowitz welcomed the guests and, in his address to them, gave a brief presentation of CUTEC and the areas in which it works. Numerous points for discussion were raised, with agricultural policy specialist Dr. Priesmeier showing particular interest in the concepts for recovery of biogas. There was a general consensus in the discussion that, with regard to the transport distances involved and the CO_2 balance, regional concepts featuring small, decentralised plant installations were more economically sustainable than large-scale installations, and that only biogenous waste materials should be used in a biogas plant.

Prof. Dr.-Ing. Carlowitz (left) and Dr.-Ing. Vodegel (right) showed the delegation around the pilot plants on their tour of the CUTEC facility

Potential input materials include manure, straw and biosolids from agriculture, and in the Harz region also wood of course. Refining the biogas into ethanol as a biofuel was considered less beneficial, as the global market is dominated by ethanol from Brazil. Instead, the parties agreed that, in use of biomass as an energy source, the best options are concepts which promote regional recycling loops and optimise the utilisation of resources based on more efficient processes. Farmers have a key role to play in this, firstly as the raw material suppliers and secondly as consumers of the by-product at the end of the renewable energy process chain, making use of the recycled ash as fertiliser and so closing the material loop. The visit by the SPD politicians concluded with a tour of the pilot plant halls, providing the guests with the opportunity to view CUTEC's pilot plants in operation at first hand. (he)

OptiBtLGas

Designer fuel from green gas

A short acronym conceals a lengthy full title: Cleaning and treatment of product gas from biomass gasifiers – Optimisation of the H_2:CO ratio in synthesis gases for the production of 2nd generation fuels. Formally correctly, but hardly user-friendly. Just as is to be expected of an EU project ... The ERA-Net BIOENERGY is an EU-wide network of national research and development programmes relating to bioenergy. OptiBtLGas is supported in Germany by the FNR Agency for Renewable Resources, based in Gülzow, and in Austria by the FFG Austrian Research Sponsorship Organisation, based in Vienna. The German partners are CUTEC and H.C. Starck from Goslar. The partners from Austria, too, are organisations which enjoy high repute throughout Europe: the Technical University of Vienna and the REPOTEC and Biomassekraftwerk Güssing corporations (see picture below).

The starting point for the project was that two gasifiers for the thermal decomposition of biomass to produce synthesis gas had already been operating in Güssing and Clausthal for a number of years. The Clausthal variant is characterised by its variability in relation to different hydrocarbons, while the Güssing facility is already operating commercially as a demonstration heat and power plant. To produce artificial fuel, carbon monoxide (CO) and hydrogen (H_2) are needed. To make artificial diesel - the so-called BtL - a ratio of 2:1 is sufficient; for natural gas powered vehicles, however, a ratio of 3:1 is required. The mission of the OptiBtLGas project is to produce the missing component H_2 from CO and water. The object is to transfer the energy in the biomass into the fuel at the highest possible efficiency. The partners divided the various tasks up among themselves: at the facility in the Harz region the focus was placed on treating the raw gas directly after gasification and dedusting, while down in the Austrian region of Burgenland the purified gas prior to synthesis was used.

Project logo

Partner logos

The notable aspect of the project is that, with the pilot plant in Clausthal and the demo plant in Güssing, once again two organisations came together in an EU project which were pursuing different approaches to fluidised-bed gasification. While the facility in Clausthal is investigating the autothermal principle with the use of steam and oxygen, the Güssing-based team favours the allothermal fluidised bed system, featuring two machines and using steam and air, as perfected at the TU Vienna under Professor Hofbauer. The involvement of the H.C. Starck corporation brought onboard a company with an international reputation for its expertise in the production of metallic and ceramic powders.

By joining OptiBtLGas, the company ventured into the new field of catalyst production for bioenergy processes.

To ensure communication between the partners, half-yearly plenary sessions are planned as well as bilateral working group meetings of the various partners as required. As the project coordinator, CUTEC compiled the project handbook and drew up the relevant contracts, and in future it will also be responsible for updating the schedule and for contacts with the EU. The project was launched in the Spring of 2008. It is scheduled to end in April 2010. By then, all the partners hope that there will be a great deal to report. (vo)

CUTEC shows at national trade fairs

Presentation of innovative research at IFAT in Munich and at the Hanover Industry Fair

From May 5 to 9, 2008 specialists from the international environmental technology business met in Munich at IFAT, the world's largest and most important trade fair presenting new products and innovations in the fields of water and waste water treatment, waste management and recycling. The CUTEC stand in hall A3 had an international flavour in keeping with the event. A large number of visitors came to find out about our innovations in the waste water treatment and metrology fields. Among the exhibits was the latest generation of the "FlocFormer" polymer mixer for sewage sludge conditioning.

A particular highlight of the show was a visit to the CUTEC stand by Germany's Federal Environment Minister Sigmar Gabriel, who was keen to get a first-hand insight into our research activities.

CUTEC was once again this year represented at the Hanover Industry Fair, held between April 21 and 25. The joint stand headlined "Energy from Lower Saxony" profiled the Clausthal Energy Park, based on a model, a presentation of the Park control system and a live link to its machine room. Both the visitor numbers and the levels of interest in the technologies on show were pleasingly high. (wes)

Dr.-Ing. Schröder (left) explains the functions of the "FlocFormer" to Federal Environment Minister Gabriel (right)

Scientific Advisory Board of CUTEC

Professor Dr.-Ing. Thomas Turek in profile

Prof. Dr.-Ing. Thomas Turek

Professor Dr.-Ing. Thomas Turek has been Professor of Chemical Processes at the Technical University of Clausthal since December 2004. He was born in 1961 in Herten, Westphalia. From 1980 to 1982 he studied chemical technology at the University of Dortmund, and from 1982 to 1986 he studied chemical engineering at the University of Karlsruhe (TH). He gained his doctorate at the University of Karlsruhe's Institute of Chemical Process Engineering in 1992 with a thesis on the catalytic reduction of nitrogen monoxide in a rotating heat exchanger. Professor Turek spent just over a year as a Postdoc at the University of New South Wales in Sydney, Australia, before returning to Karlsruhe where, from 1994 to 1999, he undertook further scientific research into heterogeneous catalysed reactions at the Institute of Chemical Process Engineering. After obtaining his Habilitation in 1999, the following year he joined the Development Department of Bayer AG in Leverkusen. During 2001 and 2002 he headed the Department's Reaction Technology section, before going on to establish a catalysis group within Bayer Technology Service GmbH, carrying out research into heterogeneous catalysts for various chemical reactions. In 2004 he joined teaching staff of the Technical University of Clausthal, having previously rejected calls to join the Universities of Brunswick and Bayreuth in 1999 and 2000 respectively. During his career to date Professor Turek has been awarded a number of prizes and has published more than 60 papers. In October 2007, at the request of Professor Carlowitz, he was appointed to the Scientific Advisory Board of CUTEC. Asked about his motivation, he replied: "I see an outstanding synergy and mutual enrichment through the links between the basic research carried out at the TU Clausthal and the pilot plants operated by CUTEC in the fields of Fischer-Tropsch synthesis and fuel cell research. I aim to strength those areas by my contributions." (he)

Continuation from page 1

aquen GmbH – the first company to be established originating from CUTEC

some 100,000 € at the company facility enabled it to be fitted out with state-of-the-art machinery, establishing a system of mutually complementing production between Stahl-Projektbau Wentz and aquen. One final large-scale machine a new CNC plasma cutter - is scheduled to be put into operation in mid-October, then the plant will be up to full production capacity.

The company produces and markets the "FlocFormer" process, providing targeted conditioning of sludge and water; "FlocSens", an analyser of flocked particle systems; and "SludgeVALUE", a process for low-pressure homogenisation of sewage sludge to increase biogas yield. All three processes were developed in the course of doctoral works at CUTEC and then successfully validated in many years of testing.

Alongside existing contacts with potential sales leads, the establishment of the new company and the market launch has generated lively interest in the processes from Europe, the USA and Asia in particular. CUTEC is not only benefiting by virtue of an enhanced reputation thanks to the new processes, it is also profiting as a shareholder in the new company and from licensing revenues. Contacts established by aquen GmbH are also looking likely to give rise to a first new research project for CUTEC in cooperation with other industrial concerns. (schr)

New in the CUTEC team

Dipl.-Ing. Felix Müller

On July 15, 2008 Dipl.-Ing. Felix Müller took up his post with CUTEC.

Mr. Müller is a graduate in energy and process technology from the Technical University of Berlin, where he wrote a degree thesis on "Conditioning of combustion and synthesis gases from biomass gasification". He will be working in the Department of Thermal Processes, supporting the successful project work being undertaken there.

On September 1, 2008 Bremen-born Anja Krage joined the Department of Chemical Analysis. After several semesters studying chemistry, Ms. Krage trained as a Chemical Technology Assistant (CTA) at the Sabine Blindow Schools in Hanover, passing the final examination with an award from the Society of German Chemists (GDCh). In her work in the CUTEC chemical analysis laboratory, Ms. Krage will primarily be focussing on questions relating to the GC/MS coupling process and to high-performance liquid chromatography (HPLC).

Anja Krage

On August 1, 2008, three young ladies took their first steps in the world of work by joining CUTEC. Josefine Müller and Jessica Micke started work in the administration section. Over the next three and a half years they will receive thorough training aimed at obtaining a qualification in office administration. Katharina Bednarski also joined the administration section of CUTEC on August 1st, undertaking a one-year practical internship as part of her studies at the Fachoberschule Wirtschaft commercial academy.

Congratulations…

…to Oliver Börker. After just two years' apprenticeship in the commercial section at CUTEC, he achieved an outstanding mark in his final examination in office administration, and is currently undergoing his period of community service in lieu of military service.

…to Martina Ketterer. She has successfully completed her period or retraining to become a physics laboratory assistant.

We would like to express our heartfelt thanks to both of them once again, and wish them all the best for the future.